

Korsakoff patients' memories of September 11

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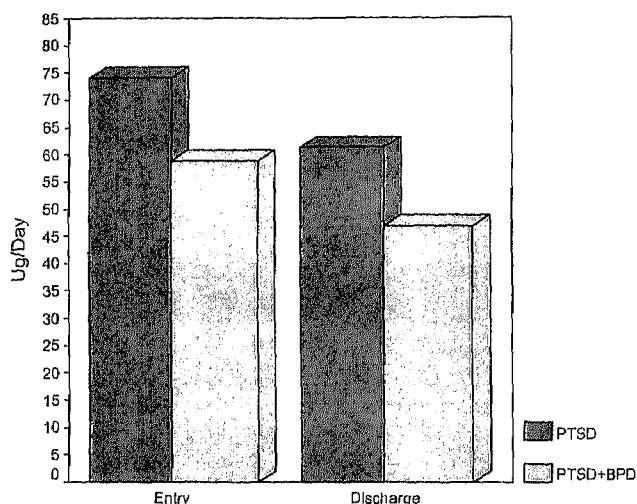


FIG. 1. Mean 24-hour urine cortisol excretion in subjects with post-traumatic stress disorder (PTSD) compared with subjects with PTSD and comorbid borderline personality disorder.

likely that additional sources of variability were present, such as variations in the stress intensity of the study conditions and the severity of illness.

It is possible that differences in cortisol excretion between the two groups reflect differences in severity of PTSD symptoms rather than factors related to BPD per se. However, the two groups in this study did not differ in level of core PTSD symptomatology (Mississippi scale) or in overall functioning (GAF score). Comorbid depression may also explain differences in cortisol between the two groups. However, our two groups did not differ in rate of comorbid depression.

Low cortisol levels in combat veterans have previously been conceptualized as psychogenically determined by emotional numbing and antiarousal-disengagement in relation to shame-laden depression (Mason et al., 2001). The lower cortisol level in the PTSD+BPD group may be seen as consistent with this conceptualization given that emotional numbing and excessive shame have been identified as core issues in BPD (Linehan, 1993). That both groups had relatively higher cortisol levels on admission compared with discharge may indicate greater activation of the HPA axis at the time of admission due to the stress of a novel environment.

The present study has a number of limitations, including small sample size, inclusion of men only, and restricted age range. Further, all subjects suffered from chronic combat-related PTSD, which may not generalize to other traumatized populations. Finally, while the present study compared PTSD alone with PTSD with comorbid BPD, it is possible that most, if not all, of the latter group met criteria for complex PTSD (Herman, 1992; Southwick et al., 1993). It may be that complex PTSD, as opposed to PTSD plus comorbid BPD, represents a more accurate clinical formulation for many of these subjects.

Conclusion

The present report suggests that relatively lower 24-hour urine cortisol excretion may be characteristic of a subgroup

of traumatized veterans with PTSD and comorbid BPD, and that comorbid BPD likely explains some of the 24-hour urine cortisol variability that has been reported among published PTSD studies (Yehuda, 2002).

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Korsakoff Patients' Memories of September 11, 2001

Flashbulb memories (FBMs) refer to detailed and vivid memories for circumstances in which one first heard news of unexpected, dramatic events (i.e., reception events; Brown and Kulik, 1977). For example, almost all Americans of a certain age remember what they were doing when they heard about the assassination of John F. Kennedy. Brown and Kulik (1977) postulated a special neural mechanism that might underlie these detailed memories, the "Now Print!" mechanism. These authors assume that activation of this Now Print!

mechanism would result in accurate and long-lasting memories. However, FBMs are not as accurate and permanent as the term suggests. Several studies have looked at the consistency of FBMs. In these studies, participants' initial reports of reception events were compared with their subsequent recalls. In general, results indicate that consistency of FBMs is far from perfect. Winningham et al. (2000) reviewed research in this domain and noted that studies in which initial reports were obtained shortly after the pertinent event generally found less consistency than studies in which initial reports were obtained after some weeks or months elapsed since the event. The authors propose two possible explanations for this finding. First, in the days following the event, people's initial reports may be tainted by postevent information provided by newspapers and television (Loftus, 1975). Second, inconsistencies may be an artifact of forgetting since most information is lost shortly after an event (Ebbinghaus, 1885/1913). Note, however, that the forgetting curve of FBMs is less steep than that of other types of memories. Conversely, like other memories, FBMs are vulnerable to suggestive influences. Thus, Crombag et al. (1996) and Ost et al. (2002) demonstrated that it is relatively easy to distort FBMs by asking participants misleading questions about the reception events. Accordingly, Christianson (1989) summarizes the literature on FBMs as follows: "FBMs are special, but not so special" (p 435).

Several determinants of FBMs have been identified. Brown and Kulik (1977) proposed that surprise and importance consequentially are necessary for FBMs to develop.³ Additionally, these authors suggested that rehearsal is a mediating variable that leads to further development of FBMs. Emotional intensity of the event also acts as an antecedent of FBMs (e.g., Conway et al., 1994; Schmolck et al., 2000). Conway et al. (1994) argued that prior knowledge plays a key role in the formation of FBMs. Prior knowledge would facilitate the assimilation of new information into the existing memory structures (for an overview see Finkenauer et al., 1998).

An interesting question is whether amnesic patients are able to form FBMs. Ikeda et al. (1998) addressed this issue by interviewing Alzheimer disease (AD) patients from the Kobe district area about the Kobe earthquake in 1995. Ten weeks after the disaster, participants' ($N = 51$) memory of the earthquake was assessed. Eighty-six percent of the patients who could not recall events that happened minutes or hours ago did remember the earthquake. However, semantic knowledge about this event was not retained. According to the authors, the emotional significance of the event might explain why many of their AD patients had some recollections of the earthquake. Referring to the amygdala's role in emotional memory (for an overview see Cahill and McGaugh, 1996), Ikeda et al. (1998) speculated that relative sparing of the amygdala in AD could underlie FBMs of their patients. In a follow-up study, these authors used magnetic resonance imaging (MRI) to determine amygdala and hippocampal vol-

umes in a subset of their patients (Mori et al., 1999). It was found that impairment of memory of the earthquake was related to amygdala damage and, to a lesser extent, hippocampal damage. Thus, the results provide further evidence of the amygdala's involvement in the formation of FBMs.

The aim of the current study was to examine FBMs and their consistency in another amnesic population—patients with Korsakoff syndrome (KS; Kopelman, 1995). Previous studies by Ikeda et al. (1998; Mori et al., 1999) on FBMs in amnesic patients did not address their consistency. We interviewed patients and healthy control subjects twice about September 11, 2001. On that day, terrorists attacked the New York Twin Towers and the Pentagon by airplane and were responsible for more than 3000 deaths.

Methods

Participants. The clinical group comprised 15 KS inpatients (4 women). Their mean age was 53.80 years ($SD = 6.47$; range, 43 to 63 years), and their mean educational level was 4.07 ($SD = 1.28$; Verhage, 1965). All KS patients had been diagnosed with KS by an experienced clinician before September 11, 2001, and they were all hospitalized at the time the terrorist attacks took place. The control group included 15 subjects (4 women). Their mean age was 52.27 years ($SD = 7.83$; range, 40 to 67 years), and their mean educational level was 4.40 ($SD = 1.76$). The two groups did not differ with regard to age and education level ($t < 1.0$). Informed consent was obtained from all participants.

Materials and Procedure. The initial semistructured interview took place approximately 7 months after the target event. During that interview, FBM questions were asked. These questions were based on FBM questionnaires (FMQs) developed by Cohen et al. (1994), Conway et al. (1994), and Davidson and Glisky (2002). The first question asked participants what happened on September 11, 2001 (Section A: Event recall). If participants were not able to recall the specific event, one or two cues (i.e., New York, planes) were given. When participants were not able to recall the event after cues had been given, the interview stopped. Event recall was followed by questions about the reception events (Section B: Personal memory: Where were you? What were you doing before you heard the news? What did you do after you heard the news? Who were you with? How did you hear the news, i.e., from what source?) and by self-reports about the emotional impact of the event on a 5-point scale (1 = not at all; 5 = extremely). Finally, six forced-choice, semantic knowledge questions about the event were asked (Section C: General knowledge). See Appendix for items of the FMQ.

The retest was conducted approximately 2 months after the initial test. Participants were asked exactly the same questions. Participants who were not able to recall the specific event at initial testing (five KS patients) were excluded from the follow-up interview. Moreover, two patients were discharged from hospital, leaving eight KS patients for the retest. Two control participants were not available for the follow-up interview, leaving 13 for the retest.

³ Wessel I, Peeck V, Foster J, Merckelbach H, Wiers R (2002) Death of a princess: A study of flashbulb memory. Unpublished manuscript.

Scoring. Answers to the first question ("What disaster took place on September 11, 2001?") were scored as follows. Participants were assigned a score of 0 when they did not provide an answer to the questions, a score of 1 when they gave a vague, nonspecified description of the event (*e.g.*, "it was war"), and a score of 2 when they gave a specified description of the event. Scoring format for reception questions (Section B) on the initial and delayed test was derived from Davidson and Glisky (2002). For the initial test, participants were assigned a score of 0 when they did not provide an answer to a question and a score of 1 when they did. FBM scores ranged between 0 and 6. For the delayed test, two independent judges rated the consistency between the answers on the initial and delayed test. They assigned a score of 0 at retest when no answer was provided or when the answer was completely inconsistent. A score of 1 was given when initial and retest answers were essentially the same but differed in specificity (*e.g.*, "My daughter told me by telephone" *vs.* "My daughter told me"). A score of 2 was given when the retest answer was highly consistent with the initial answer. When no answer was provided at the initial test, this item was eliminated from the consistency measurement. Interrater reliability score for the consistency measures was .85 (inconsistencies between the two judges were solved by a third judge). The scores of the six reception questions at retest were summed. Next, we computed a consistency score. Because some items were excluded for some participants, proportions were calculated by dividing summed consistency scores by FBM scores. Next, this score was divided by 2. Thus, consistency scores ranged from 0 to 1, with a score of 0 indicating complete inconsistency and a score of 1 indicating complete consistency between initial test and retest. Semantic knowledge questions were assigned a score of 0 for a wrong answer and a score of 1 for a correct answer. Thus, semantic knowledge scores varied from 0 to 6.

Results

Event Recall. On the initial test, 10 KS patients (67%) recalled the target event (2 nonspecific answers). One patient needed one cue to recall the event, while two patients needed both cues. Five patients were not able to answer the first question even after two cues had been given. In contrast, all of the 15 control participants were able to recall what happened on September 11 without cues [$\chi^2(2) = 10.91$; $p < .01$]. During the retest, three (37.5%) patients recalled the target event without cues, two patients needed one cue (one nonspecific answer), and two needed two cues to recall the event. Again, all control participants recalled the event without cues [$\chi^2(2) = 10.66$; $p < .01$].

Personal Memory. KS patients obtained lower FBM scores than control subjects; means were 5.10 ($SD = .88$) and 6.00 ($SD = .00$), respectively [$t(23) = -4.03$; $p < .01$]. Also, KS patients displayed lower consistency scores than control subjects; means were .28 ($SD = .21$) and .65 ($SD = .18$), respectively [$t(18) = -4.16$; $p < .01$]. On both test occasions, however, patients and control subjects did not differ with regard to their subjective impact ratings ($t < 1.5$; $p > .1$).

Semantic Knowledge. On the initial test, KS patients obtained slightly lower scores on Section C of the interview (semantic knowledge) than control participants; means were 2.70 ($SD = .82$) and 3.53 ($SD = 1.25$), respectively. However, this difference attained only borderline significance [$t(23) = -1.86$; $p = .08$]. Note that none of the participants answered all questions correctly; the maximum scores were 4 ($N = 2$) and 5 ($N = 4$) for KS patients and control subjects, respectively. On the retest, KS patients obtained lower scores on Section C than control subjects; means were 1.86 ($SD = 1.57$) and 4.15 ($SD = 1.14$), respectively [$t(18) = -3.76$; $p < .01$]. This time, two control subjects obtained the maximum score of 6, while none of the KS patients attained this score. KS patients' decrease of semantic knowledge over time was borderline significant [$t(6) = 2.12$; $p = .08$]. Similarly, increase of semantic knowledge in control subjects was borderline significant [$t(12) = -1.86$; $p = .09$].

Discussion

The results of the current study can be summarized as follows. First, despite dense amnesia, more than half of the KS patients remembered the attack on September 11, 2001. Second, these patients displayed FBMs. Third, although FBMs of healthy control subjects were rather consistent, those of KS patients were not. In contrast, patients and control subjects did not differ in their subjective impact ratings of the attacks. Fourth, KS patients tended to have less semantic knowledge about the target event than control subjects on both test occasions. Moreover, their semantic knowledge tended to decrease with time. Conversely, control subjects' semantic knowledge tended to increase.

Our findings are, to some extent, in line with those reported by Ikeda et al. (1998). These authors found that the majority of their AD patients from the Kobe area were able to remember the Kobe earthquake. The relative sparing of the amygdala in AD and in KS may account for retained emotional memory in both patient groups. During the early stages of AD, brain damage is largely confined to the hippocampus and adjacent areas (Morris, 1996), while with KS, lesions are limited to the mammillary bodies, the anterior part of the thalamus, and sometimes the frontal lobes (Kopelman, 1995). The present results are also consistent with Hamann et al. (1997), who found that healthy control subjects and amnesic patients (including those with KS) better remembered pictures with high emotional intensity than neutral material. Likewise, in their experimental study with KS patients, Johnson et al. (1985) showed that patients developed a clear preference for photographs of people who had been described in favorable terms on an earlier test occasion, although they had great difficulties in remembering the semantic details of the favorable information. The AD patients studied by Ikeda et al. (1998) did not exhibit semantic memory for the disaster, whereas our KS patients had some semantic knowledge about the terrorist attacks on September 11, 2001. This latter finding is in accordance with previous studies showing that amnesic patients may be able to learn new semantic information (Tulving et al., 1991).

In contrast to healthy control subjects, our KS patients did not report consistent FBMs. This suggests that FBMs of KS

patients are not very accurate. It is well documented that patients with this disorder have the propensity to confabulate, mainly because of reality-monitoring deficits brought about by frontal lobe dysfunction (Weinstein, 1996). Hence, it could well be the case that FBMs of KS patients involve confabulations. We have anecdotal evidence for this notion: some of the patients said that they were at home (they mentioned their former residence) when they heard the news of September 11, while in fact they were all residing in the clinic. However, this issue warrants further study.

Our study suffered from several limitations. First, the sample of KS patients was relatively small, and dropout at retest was considerable. Second, information about memory performance of patients on formal tests or about structured brain abnormalities was not available. Meanwhile, such information would have allowed for a more thorough analysis of the antecedents of KS patients' FBMs.

In summary, our results show that amnesic patients are capable of remembering a highly emotional event, including some semantic details. However, they do not seem to have accurate FBMs for such events.

Appendix: Flashbulb Memory Questionnaire

Section A: Event Recall.

1. Do you know which disaster took place on the September 11, 2001?

Section B: Personal Memory.

1. Where were you when you heard the news?
2. What were you doing before you heard the news?
3. What did you do after you had heard the news?
4. Who were you with?
5. What time of the day did you hear the news?
6. How did you hear the news? From what source?

Section C: Semantic Knowledge.

1. How many planes were involved in the attack on the World Trade Center?
2. What was the time interval between the crash of the second plane into the WTC and the collapse of the first tower?
3. What other building was attacked on September 11, 2001?
4. What time (Dutch time) was it when the first attack took place?
5. A third plane crashed. Do you know near which town this plane crashed?
6. Which company did the planes belong to?

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Engaging and Following Trauma Survivors in Real World Clinical Investigations

Each year in the United States more than 2 million Americans incur traumatic injuries so severe that they require